Climate Change Adaptation Advisory Committee

Overview for the Massachusetts Legislature on Climate Change Adaptation

Presentation Title: Presentation by the Natural Resource Subcommittee

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CLIMATE CHANGE ADAPTATION

An update to the MA Legislature



NATURAL RESOURCES

Andy Finton, The Nature Conservancy

KEY NATURAL RESOURCE SECTORS

1. Aquatic Ecosystems
2. Wetland Ecosystems
3. Forest Ecosystems
4. Coastal Ecosystems

- Surrogates for the species and processes that define the commonwealth's natural resources

ECOSYSTEM FUNCTIONS (SERVICES)

- Wildlife habitat
- Biodiversity
- Water quality/Purification
- Water storage/Supply/Aquifer Recharge
- Flood Attenuation
- Coastal protection
- Carbon sequestration
- Soil formation

FUNCTIONS → VULNERABILITIES → STRATEGIES

- Assessed vulnerabilities and impacts
  - Many universal across ecosystems, some unique
  - Synergy with other stressors
- Adaptation strategies to:
  - Help ecosystems resist climate effects
  - Make vulnerable ecosystems more resilient
- Win–Win adaptation strategies
  - Ecosystem function = Ecosystem services
    - Benefit natural resources & economic, infrastructure, human health and welfare, coastal, and other sectors

CLIMATE CHANGE ADAPTATION EXAMPLE

Cold Water Rivers, Streams, and Watersheds

Functions

- Drinking water
- Flood attenuation
- Recreation
- Biodiversity
- Fish habitat

Current stressors

- Habitat fragmentation
- Runoff
  - Sedimentation
  - Temperature

Climate Vulnerability

- Summer drought
  - Fragmentation
  - Species loss
- Temp increase
  - Water quality

ADAPTATION STRATEGIES

- Headwater and riparian protection
  - Forests keep water cold, clean, w/steady flow
- Restore connectivity
  - Enhances connectivity, especially during summer drought
- Flexible wetland and river regulation
  - Facilitate protection and restoration of headwaters, and wetlands

KEY VULNERABILITIES

- Changing Precipitation (extreme weather events)
  - Summer drying of wetlands
  - Spring flooding and altered hydrology
    - Increased flooding, erosion, disrupt life cycles & migration
  - Water stress on individual species
    - Water stress on trees and other plants
  - Altered fire regimes

- Rising Temperatures
  - Temperature stress on individual species
    - Vulnerability to pathogens
    - Lower dissolved oxygen
  - Less winter snow and ice, altered wetland and river hydrology

KEY VULNERABILITIES

- Sea Level Rise Storm surge
  - Inundation and decrease in coastal habitats
  - Severe storms alter coastal structure

- Indirect vulnerabilities and synergy with other stressors
  - Increased invasive plants, insects, and diseases
  - Altered phenology (timing) and food web relationships
  - Habitat fragmentation limits species movement in response to climate

CLIMATE ADAPTATION STRATEGY TYPES

1. Land & Water Protection
   - Acquisition and Easements
2. Restoration & Management
3. Policy & Flexible Regulation
   - Funding
   - Planning and Prioritization
4. Monitoring, Research, and Adaptive Management

STRATEGIES: OVERARCHING PRINCIPLES

- Nature Based Solutions
  - "Soft" solutions or Ecological ("Green") Infrastructure
    - "nature's capacity to provide freshwater, climate regulation, soil formation, erosion control and natural risk management…"
      - UNEP: The Economics of Ecosystems and Biodiversity
  - Cost effective
    - "If 'moral prerogative' isn't reason enough to invest in protecting nature, here's another one: it's just been found to bring up to hundredfold return on capital -better than an investment in gold. Putting money into protecting wetlands and forests could be the best financial move one could ever make."
    - "Maintaining nature's capacity to fulfill these functions is often cheaper than having to replace lost functions by investing in alternative heavy infrastructure and technological solutions"

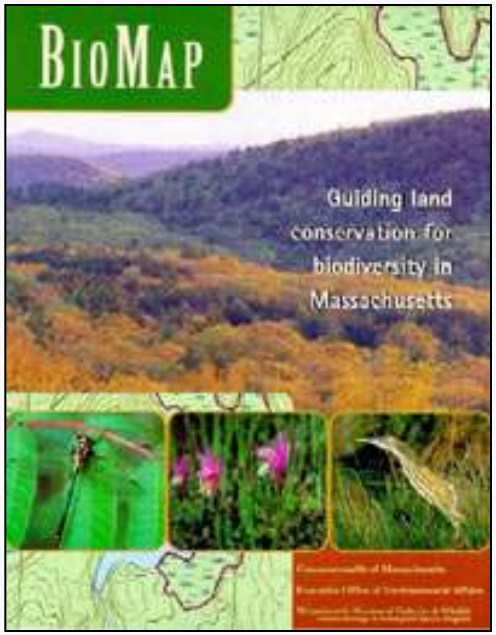
STRATEGIES: OVERARCHING PRINCIPLES

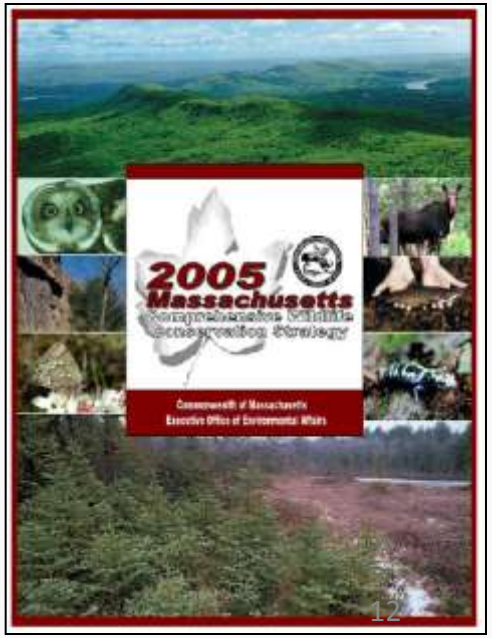
- **Resilience:** The capacity for renewal in a dynamic environment - Gunderson 2000

- Enhance resilience & ecosystem function
  - **Size:** Protect Ecosystems of Sufficient Size
  - **Representation:** Represent & protect environmental settings
  - **Replication:** Distribute risk across geographically-dispersed replicates
  - **Connectivity and integrity:** prevent isolation, maintain buffers
  - **Limit Stresses**:
  - Restore fragmenting features
  - Prevent and control invasive plants, insects, and diseases
  - **Function:** Manage for ecological processes & functions
  - **Richness:** Support biodiversity richness

STRATEGIES: OVERARCHING PRINCIPLES

- Develop more ecologically sound planning
- Focused and collaborative conservation
  - State Wildlife Action Plan & BioMap
    - Blueprint for conserving functional ecosystems
    - Potential catalyst for federal climate adaptation funding





Potential Strategy #1:
RIVER and WETLAND PROTECTION

** Ecosystem Services/other sectors*

- Targeted acquisition (or easements), examples:
  - Future coastal wetlands
    - *Coastal infrastructure protection*
  - Headwater streams and vegetated buffers
    - *Flood attenuation*
  - Intact riverine and wetland complexes, and floodplains
    - *Water quality and storage*
  - Critical coldwater fish habitat
    - *Recreation*
  - Vernal pool habitat

Potential Strategy #2: FOREST PROTECTION

- Targeted acquisition (or easements), examples:
  - Forest reserves/cores
    - *Carbon sequestration* 

  - Working woodlands
    - *Forest products*
    - *Tourism*
    - *Water quality, flood attenuation*

Potential Strategy #3:
WETLAND MANAGEMENT and RESTORATION

- **Wetland Ecosystems**
  - *flood attenuation, water storage, water quality*
  - Develop flexible, climate-responsive resilience strategies
    - Promote restoration of river processes and riparian management
    - Reduce nutrient loading of water bodies
    - Encourage application of bioengineering techniques for erosion control and stream stability
- **Coastal Wetlands**
  - Remove impediments to inland migration
    - *Reduce threats to infrastructure*

Potential Strategy #4:
RIVER MANAGEMENT and RESTORATION

- **Aquatic Ecosystems:** watershed-scale and reach-level
  - *flood attenuation, infrastructure integrity*
  - Protect and restore habitat connectivity
    - Within stream
    - Stream-floodplain
  - Protect and maintain ecological flows
  - Promote restoration and creation of floodplains
  - Restore and protect aquatic ecosystems
    - Riparian buffer areas
    - Floodplains

Potential Strategy #5:
FOREST MANAGEMENT and RESTORATION

- Maintain vigor & increase factors that promote resilience (diversity of species, forest structure, age, genetic variability)
  - *C sequestration* M
  - *Forest products*
- Protect regeneration
- Apply prescribe fire management
  - *Reduced threat of wildfire*

Potential Strategy #6:
PLANNING, COORDINATION, FUNDING

- Develop more ecologically sound planning
  - Climate responsive & integrated land use planning & zoning
  - Smart growth tools and strategies; Low Impact Development
  - Promote sustainable development and storm water management
  - Watershed planning and technical assistance
  - Discourage development in sensitive areas (floodplains, coastal)
- Increased coordination among state agencies, across states, and w/NGOs and academic entities.
- Climate-adapted State Wildlife Action Plan (SWAP)
  - catalyze federal adaptation funds, galvanize conservation

Potential Strategy #7: WETLAND and RIVER POLICY

Flexible regulations to protect wetland and aquatic ecosystems

- Wetlands Protection Act:
  - Revise to respond flexibly to a changing climate, Incorporate:
    - greater protection of buffer zones, isolated wetlands, vernal pools (clusters and buffers), and intermittent streams
    - flexible wetland delineation criteria that account for drought conditions
  - provide streamlined & expedited permitting for dam removal, and other restoration projects

- The Rivers Protection Act should be revised to
  - protect meander belt-width river corridors
  - Promote restoration of, and discourage development in floodplains
  - Adopt stream crossing standards

- Encourage flood control compatible with other values

Potential Strategy #8:
COASTAL POLICY, FLEXIBLE REGULATION

- **Coastal Ecosystems**
  - Better Engineering-Ecological solutions to SLR
  - Minimize development to aid inland migration
  - Integrated Community Planning

Potential Strategy #9:
FOREST POLICY

- **Forest Ecosystems**
  - Establish landowner incentives to keep forests as forests
    - Enhance Chapter 61 enrollment
  - Take advantage of carbon credits
  - No Net Loss and No Net Fragmentation policies

Potential Strategy #10:
MONITORING, RESEARCH and ADAPTIVE MANAGEMENT

- Develop better understanding of CC impacts on species and ecosystems
  - Monitor pilot adaptation strategies
  - Research interactions among stressors
  - Track movement of tidal resources responding to SLR (gauges, LiDAR, etc.)
  - Update FEMA floodplain maps
  - Improve understanding of river and geomorphic processes
- Support and integrate w/ Long Term Ecological Research/Monitoring
- Standardize monitoring protocols
  - Consolidate MassGIS and NRCS soils mapping and use as tool for management of soil carbon stores
- Prepare and distribute CC Adaptation best management practices

NATURAL RESOURCE ADAPTATION SUMMARY

- Massachusetts ecosystems provide valuable services
  - Benefit all sectors in the face of climate change
- Climate Change/other stressors reduce resilience
- Nature Based Solutions
  - Most cost effective
  - Protect and restore ecosystem resilience & function
    - Land & Water Protection
    - Policy & Flexible Regulation
      - Funding
      - Planning and prioritization
    - Restoration & Management
    - Monitoring, Research, & Adaptive Management


Thank you
Questions?